



**16HA-861
16HA-860
15H-860**

PORTABLE AM/FM/SW FULL-BAND RADIO

SERVICE MANUAL

SPECIFICATIONS

Frequency Range	FM 87.5 – 108 MHz LW 150 – 350 KHz MW 515 – 1620 KHz SW1 2.3 – 5.2 MHz SW2 5.95 – 7.3 MHz SW3 9.5 – 12.5 MHz SW4 14.5 – 18.0 MHz
Intermediate Frequency	FM 10.7 MHz AM 455 KHz
Sensitivity (for 50mW output)	FM 5 μ V (30dB S/N) LW 50 μ V/m MW 25 μ V/m SW1 30 μ V/m SW2 20 μ V/m SW3 20 μ V/m SW4 3.2 μ V
Power Output	Undistorted 1.4W Maximum 2.0W
Power Supply	DC 9V, Six 1.5V "D" Batteries AC, 110V/220V for model 16HA-861 and 16HA-860
Current Drain	No Signal 40 mA Maximum 380 mA
Speaker	4" x 6" permanent dynamic type 4 ohm voice coil impedance
Dimensions	14 $\frac{1}{2}$ " wide x 8" high x 4 $\frac{3}{4}$ " deep
Net Weight	7 $\frac{1}{2}$ lbs.

This Manual contains information compiled from basic engineering data of model 16HA-861. Some minor changes or modifications different from contents in this manual may be found in units of latest production.

SANYO ELECTRIC CO., LTD.

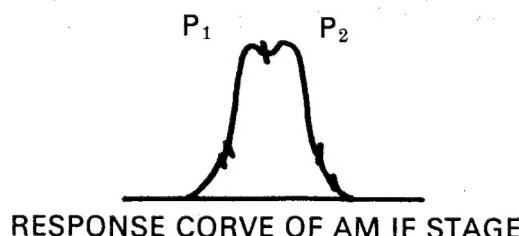
ALIGNMENT PROCEDURES

Band Coverage & Tracking Alignment

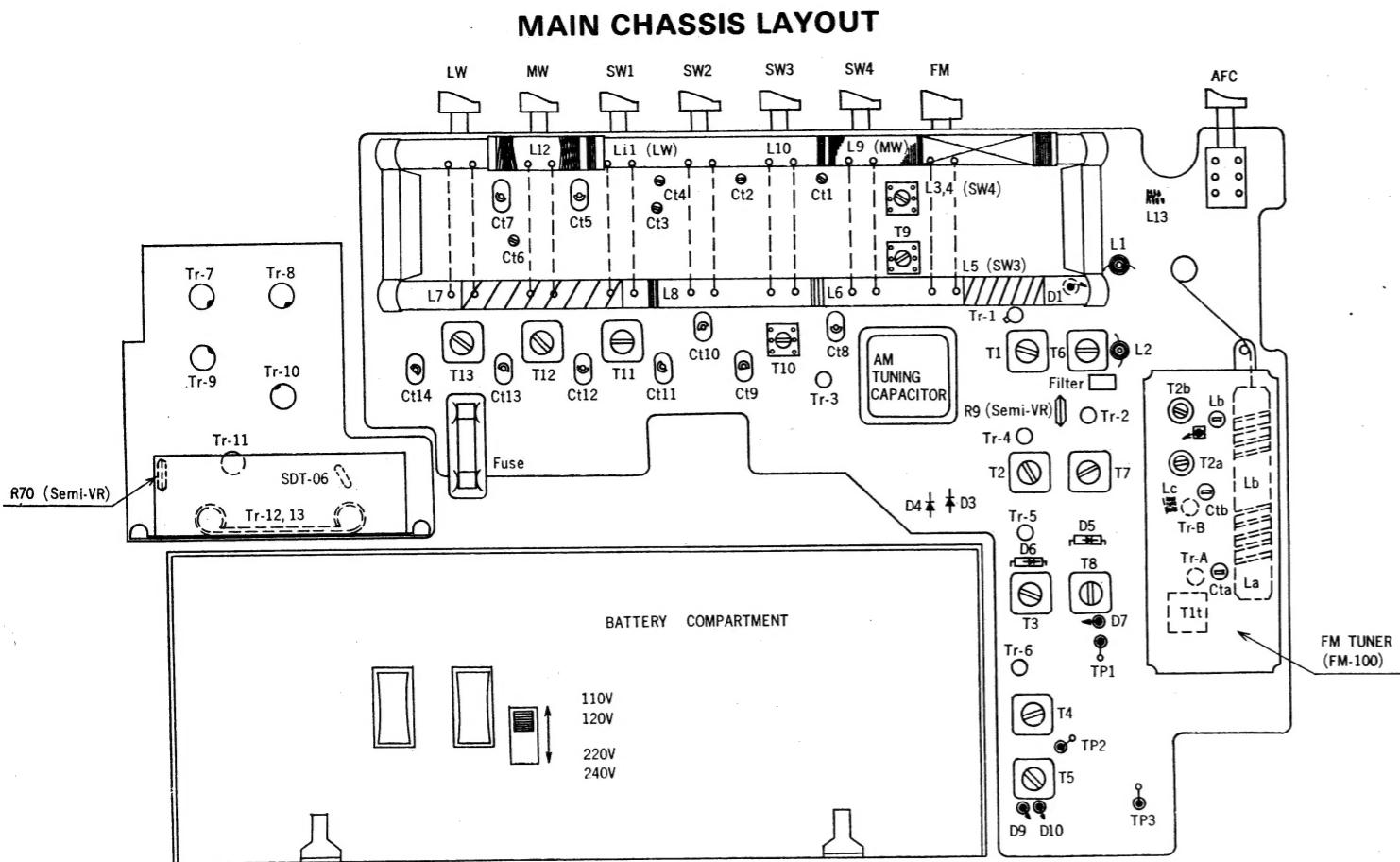
Procedures	Position of Band Switch	Signal Input	Frequency of Signal Gen.	Dial Setting of Radio	Components to be Adjusted
FM IF STAGE	FM	Dummy Ant	10.7 MC	87 MC	FM IF Transformers T4, T3, T2, T1, T2a & T2b
FM DISCRIM.	FM	Dummy Ant	10.7 MC	87 MC	FM IF Transformer T5
FM BAND COVERAGE	FM	Dummy Ant	89 MC	89 MC	Oscillator Trimmer Ctb
	FM	Dummy Ant	106 MC	106 MC	FM Oscillator Coil Lb
FM TRACKING	FM	Dummy Ant	98 MC	98 MC	FM RF Trimmer Cta
AM IF STAGE	SW1	Thru 0.1 μ F	455 KC	Lowest End	AM IF Transformer T8 T7 & T6
MW BAND COVERAGE	MW	IRE Loop	505 KC	Lowest End	MW Oscillator Coil T12
	MW	IRE Loop	1650 KC	Highest End	MW Oscillator Trimmer Ct13
MW TRACKING	MW	IRE Loop	600 KC	600 KC	MW Antenna Coil L9 L10
	MW	IRE Loop	1400 KC	1400 KC	MW Antenna Trimmer Ct6
LW BAND COVERAGE	LW	IRE Loop	145 KC	Lowest End	LW Oscillator Coil T13
	LW	IRE Loop	365 KC	Highest End	LW Oscillator Trimmer Ct14
LW TRACKING	LW	IRE Loop	160 KC	160 KC	LW Antenna Coil L11 L12
	LW	IRE Loop	340 KC	340 KC	LW Antenna Trimmer Ct7
SW1 BAND COVERAGE	SW1	IRE Loop	2.23 MC	Lowest End	SW1 Oscillator Coil T11
	SW1	IRE Loop	5.2 MC	Highest End	SW1 Oscillator Trimmer Ct12
SW1 TRACKING	SW1	IRE Loop	2.4 MC	2.4 MC	SW1 Antenna Coil L7 L8
	SW1	IRE Loop	4.7 MC	4.7 MC	SW1 Antenna Trimmer Ct5
SW2 BAND COVERAGE	SW2	IRE Loop	5.95 MC	5.95 MC	SW2 Oscillator Trimmer Ct10
	SW2	IRE Loop	7.0 MC	7.0 MC	SW2 Oscillator Trimmer Ct11
SW2 TRACKING	SW2	IRE Loop	5.95 MC	5.95 MC	SW2 Antenna Trimmer Ct3
	SW2	IRE Loop	7.0 MC	7.0 MC	SW2 Antenna Trimmer Ct4
SW3 BAND COVERAGE	SW3	IRE Loop	9.30 MC	Lowest End	SW3 Oscillator Coil T10
	SW3	IRE Loop	12.4 MC	Highest End	SW3 Oscillator Trimmer Ct9
SW3 TRACKING	SW3	IRE Loop	9.7 MC	9.7 MC	SW3 Antenna Coil L5 L6
	SW3	IRE Loop	11.7 MC	11.7 MC	SW3 Antenna Trimmer Ct2
SW4 BAND COVERAGE	SW4	Dummy Ant	14.9 MC	Lowest End	SW4 Oscillator Coil T9
	SW4	Dummy Ant	18.2 MC	Highest End	SW4 Oscillator Trimmer Ct8
SW4 TRACKING	SW4	Dummy Ant	15.5 MC	15.5 MC	SW4 Antenna Coil L3 L4
	SW4	Dummy Ant	17.7 MC	17.7 MC	SW4 Antenna Trimmer Ct1

NOTE:

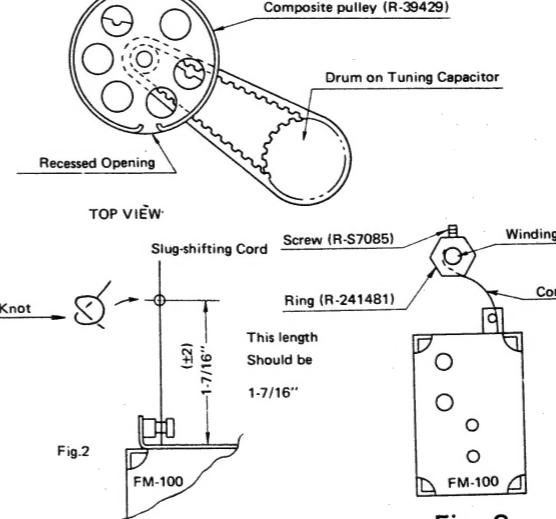
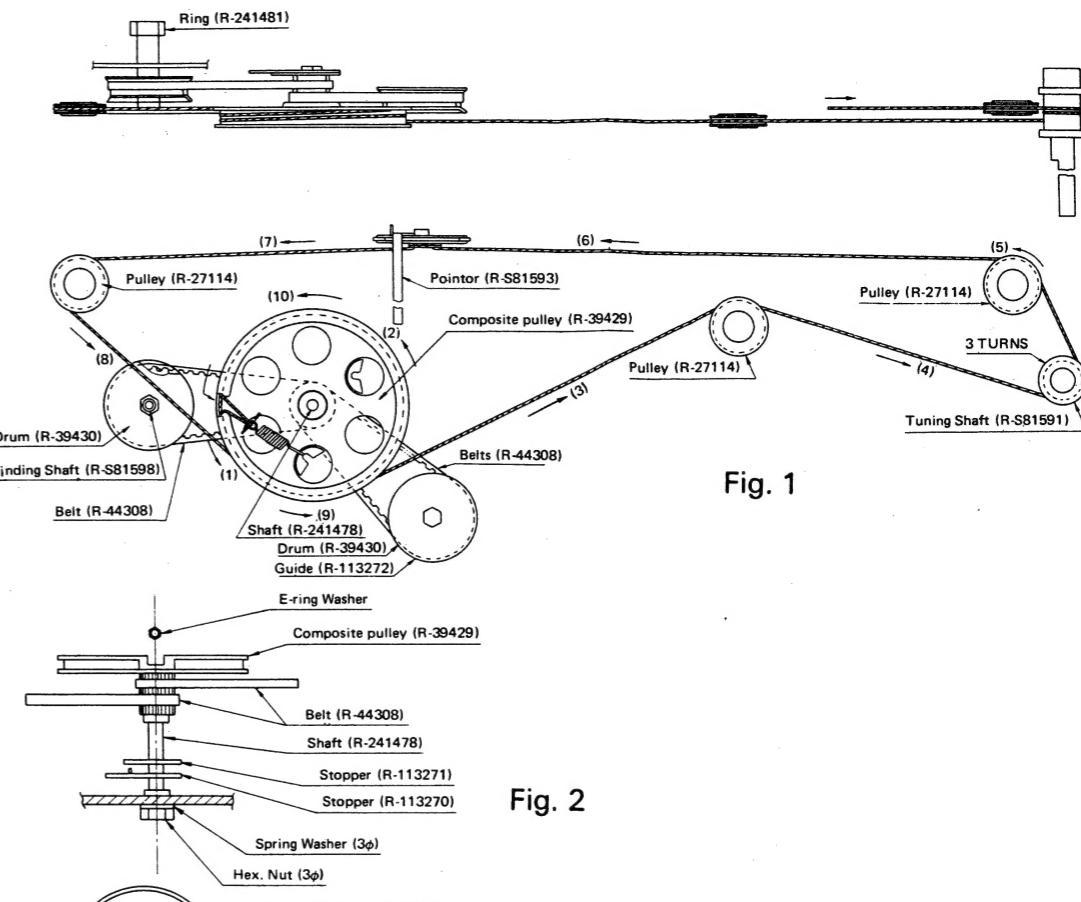
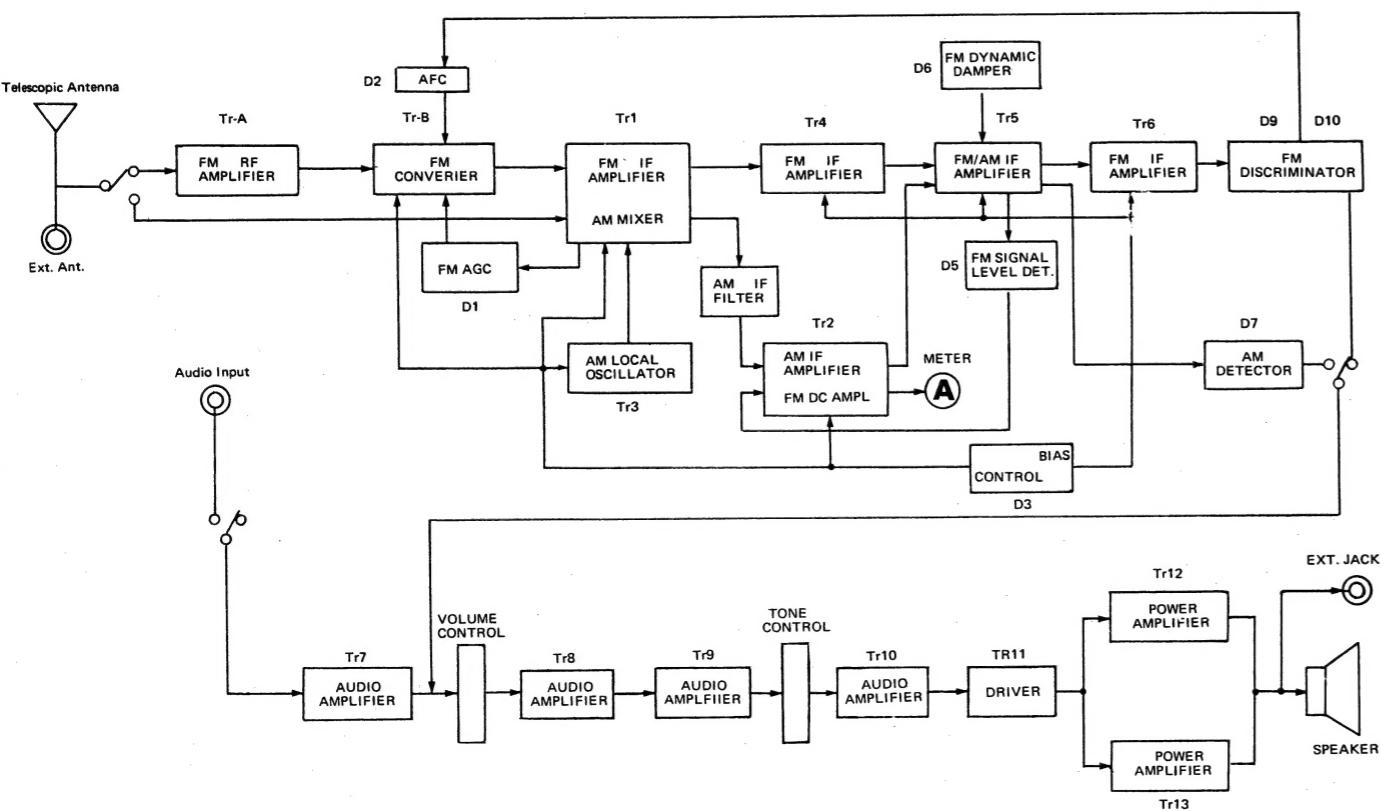
1. Repeat OSC and RF adjustments in each Band until no further improvement is noted.
2. Align SW2 before SW3, as any coil adjustment on SW2 will effect the adjustments on SW3.
3. Adjust R9 (50K) semi-fixed resistor for 1.5 ma Collector current, Tr2. Use an ammeter with no less than 1000K series resistor.
4. Never short the base of Tr2 to ground (B+) or the base of Tr11 to common (B-), to prevent damage to these transistors. Extreme care should be taken during service or alignment of this receiver to insure these shorts not be made inadvertently by a screw driver or other test equipment.
5. R9 and R70 are both 50K ohm variable resistors. Neither of these should be set below 10K ohms whenever receiver is on, but if repair must be made to either, preset to mid range before turning receiver on.
6. Note that FM oscillator adjustments are made contrary to normal procedure. The high end is adjusted with the coil and the low end is adjusted with the trimmer capacitor, since the tuning variables are the coils.
7. The AM IF response curve is double peaked. If alignment is made with a sweep generator and oscilloscope adjust the IF transformers for maximum response and minimum valley. The 455KHz marker does not necessarily fall directly in the center of the response curve. A ceramic filter is used which determines the two peaks of this response curve.



DIAL CORD STRINGING



BLOCK DIAGRAM



INSTRUCTION FOR DIAL CORD STRINGING

- Mount Shaft (R-241478) onto chassis with Spring Washer (3φ) and Hex. Nut (3φ). Apply any lubricant onto the surface of it. Place Stopper (R-113270) and Stopper (R-113271) through Shaft, then mount Composite Pulley (R-39429) with two Belts (R-44308) attached in such a position as it's recessed opening faces downward as shown in Fig. 1 when Stoppers are hindered from swinging further by a projection on chassis.
- Mount two Drums (R-39430) temporarily onto Winding Shaft (R-S81598) and Tuning Capacitor respectively.
- One-Belt is conjugated with Drum on Tuning Capacitor in the state in which Tuning Capacitor has the minimum capacitance (been fully rotated clockwise). The other Belt is connected with Drum on Winding Shaft ordinarily without any special consideration. Then rotate Composite Pulley a full turn and check if Stopper works well without any play or not, as well as whether belt looping is correctly made with appropriate tension or not.
- Mount two Guides (R-113272) onto respective Drums with the specified screws. Be careful not to apply any notable forces onto Tuning Capacitor when fastening.
- String Dial Cord following the above illustration and locate Pointor (R-S81593) on Cord temporarily. Then place the unit into Housing and check the location of Pointor. If correctly located, fix Pointor with lacquer.
- COUPLING BETWEEN FM TUNER AND WINDING SHAFT**
Set Pointor to 106MC on dial scale of FM band (Pointor Just behind the "O" letter of 106). Pull out the slug-shifting cord (for "mu" variation of coils) from FM Tuner (FM-100) fully. Mark the point on the cord which is of 37 ± 2 millimeters distance measured from the metal casing. And make a knot on the marked point. (Fig. 2) Insert the cord through hole of Ring (R-241481) and tighten Screw (R-S7085) slightly. Apply FM signal of 106MC into input terminals (1 and 4) of FM-100 and adjust location of Ring on Winding Shaft in order to receive the signal loudest. Then fasten Ring with Screw tightened. (Fig. 3)

DIAL CORD STRINGING

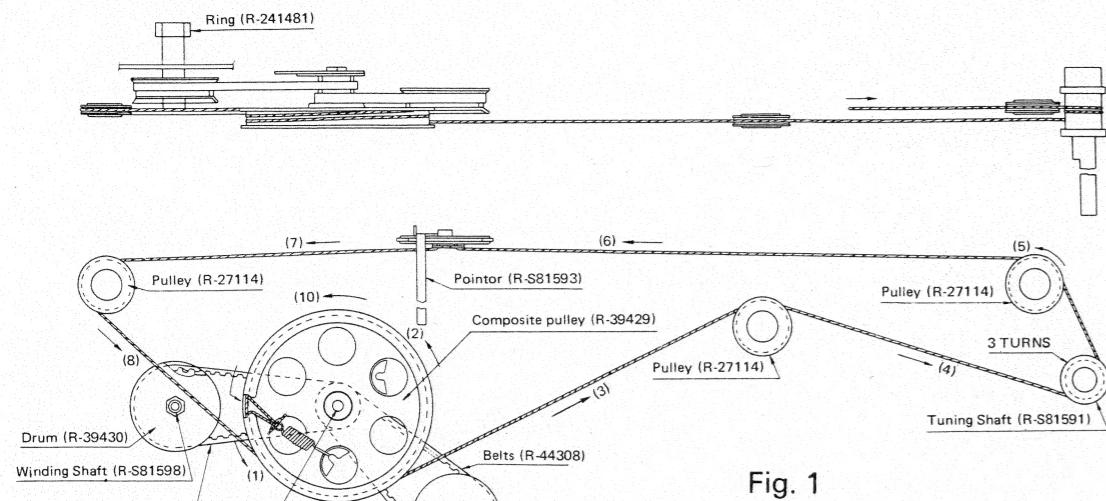


Fig. 1

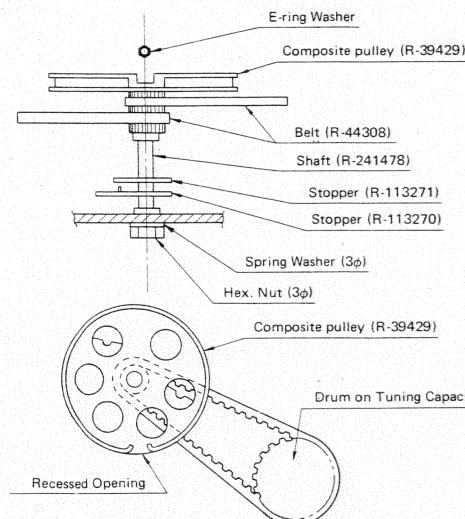


Fig. 2

INSTRUCTION FOR DIAL CORD STRINGING

- a) Mount Shaft (R-241478) onto chassis with Spring Washer (3φ) and Hex. Nut (3φ). Apply any lubricant onto the surface of it. Place Stopper (R-113270) and Stopper (R-113271) through Shaft, then mount Composite Pulley (R-39429) with two Belts (R-44308) attached in such a position as it's recessed opening faces downward as shown in Fig. 1 when Stoppers are hindered from swinging further by a projection on chassis.
- b) Mount two Drums (R-39430) temporarily onto Winding Shaft (R-S81598) and Tuning Capacitor respectively.
- c) One-Belt is conjugated with Drum on Tuning Capacitor in the state in which Tuning Capacitor has the minimum capacitances (been fully rotated clockwise). The other Belt is connected with Drum on Winding Shaft ordinarily without any special consideration.
Then rotate Composite Pulley a full turn and check if Stopper works well without any play or not, as well as whether belt looping is correctly made with appropriate tension or not.
- d) Mount two Guides (R-113272) onto respective Drums with the specified screws. Be careful not to apply any notable forces onto Tuning Capacitor when fastening.
- e) String Dial Cord following the above illustration and locate Pointor (R-S81593) on Cord temporarily. Then place the unit into Housing and check the location of Pointor. If correctly located, fix Pointor with lacquer.
- f) COUPLIGN BETWEEN FM TUNER AND WINDING SHAFT
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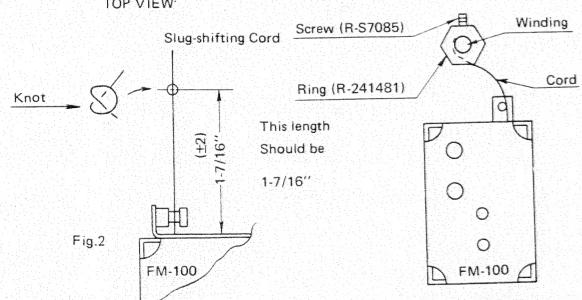
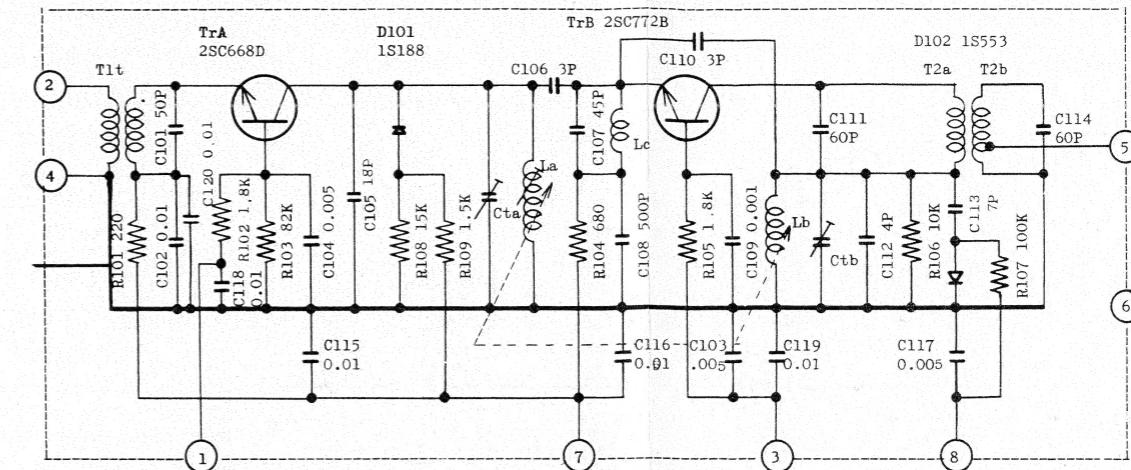
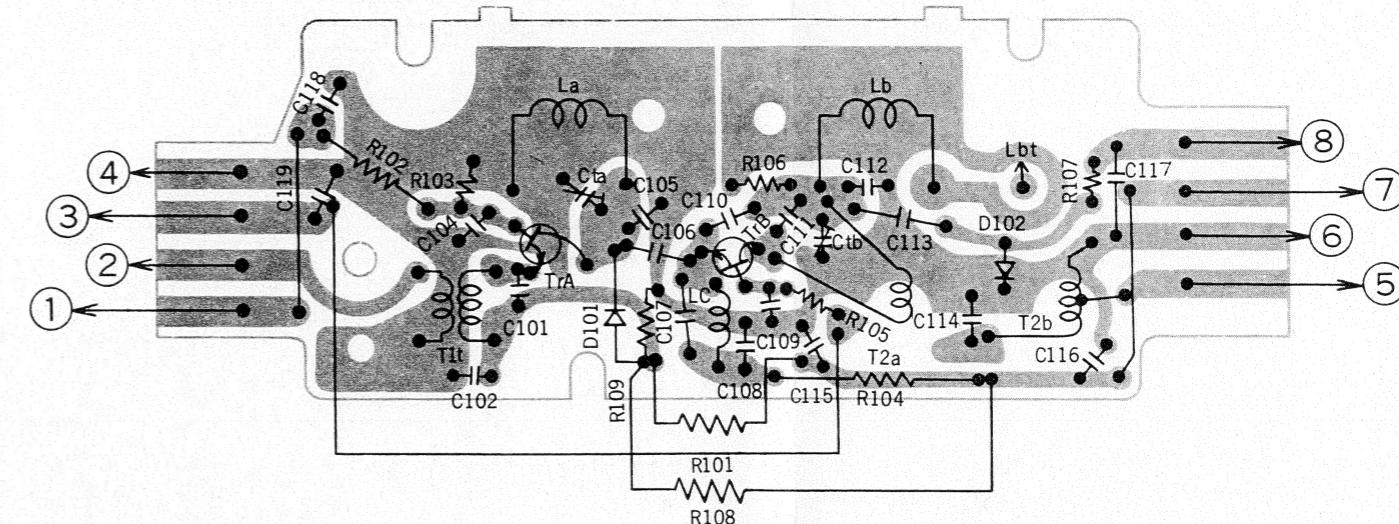


Fig. 3

**FM TUNER (FM-100) —
SCHEMATIC DIAGRAM**



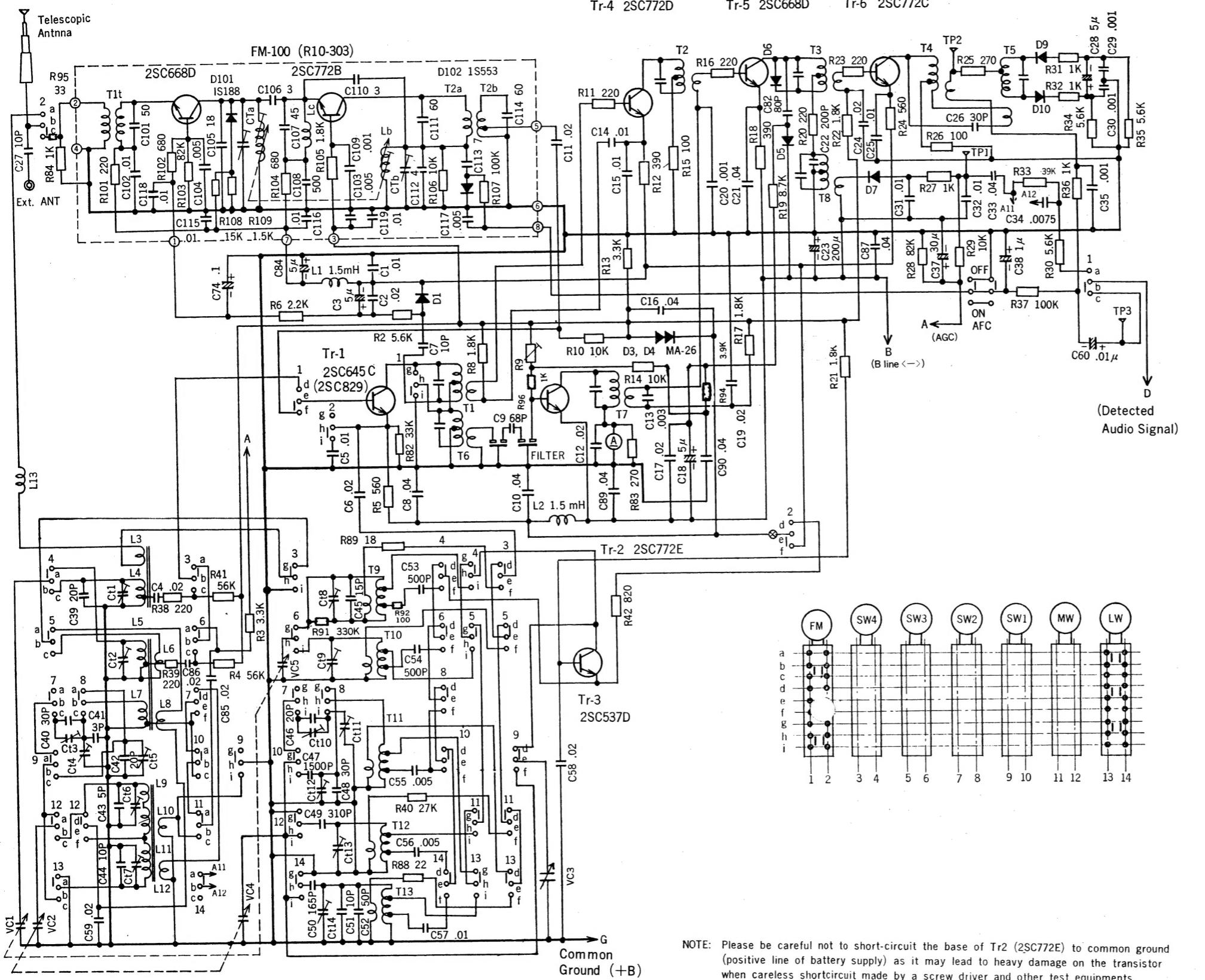
INTER-PARTS WIRING ILLUSTRATION



COMPONENT PARTS

Schematic Location	Part No.	Description	Schematic Location	Part No.	Description
<i>FIXED VALUE CAPACITOR</i>					
La Lb	R-113353a R-113354d R-113355a R-241522 R-241523 R-S81668 R-S81679 R-35314 R-35315 R-15330 R- T1t Lc T2a T2b Cta Ctb TrA TrB D101 D102	Shield Case Bottom Casing Metal Mount - guide mtg Guide Shaft Guide Variable Inductance Coil Assembly Ferrite Slug Bobbin Stopper Tension Spring Special Head Machine Screw 3x6 Antenna Coil Choke Coil 0.6uH 16 turns IF Transformer Cylinder Trimmer Transistor Transistor Diode (for FM use) Diode (variable capacitance) Printed Circuit Board	C101 C102 C115 C116 C118 C119 C103 C104 C117 C105 C106 C110 C107 C108 C109 C111 C114 C112 C113	R-CKD500K R-CKD103Z R-CKD502Z R-CKD180K R-CKD030J R-CKD450K R-CKD501M R-CKD102M R-CKD600K R-CKD040K R-CKD070K	Ceramic 50pF $\pm 10\%$ Ceramic 0.01 μ F $\pm 80\%$ Ceramic 0.005 μ F $\pm 80\%$ Ceramic 18pF $\pm 10\%$ Ceramic 3pF $\pm 0.25\%$ Ceramic 45pF $\pm 10\%$ Ceramic 500pF $\pm 20\%$ Ceramic 0.001 μ F $\pm 20\%$ Ceramic 60pF $\pm 10\%$ Ceramic 4pF $\pm 0.5\%$ Ceramic 7pF $\pm 0.5\%$
<i>FIXED VALUE RESISTORS</i>					
			R101 R102 R103 R104 R105 R106 R107 R108 R109	R-R221J R-R681K R-R823J R-R681J R-R182K R-R103K R-R104K R-R153K R-R152K	220 ohms $\pm 5\%$ 1/4W 680 ohms $\pm 10\%$ 1/4W 82K ohms $\pm 5\%$ 1/4W 680 ohms $\pm 5\%$ 1/4W 1.8K ohms $\pm 10\%$ 1/4W 10K ohms $\pm 10\%$ 1/4W 100K ohms $\pm 10\%$ 1/4W 15K ohms $\pm 10\%$ 1/4W 1.5K ohms $\pm 10\%$ 1/4W

SCHEMATIC DIAGRAM
(RF and IF Stages)

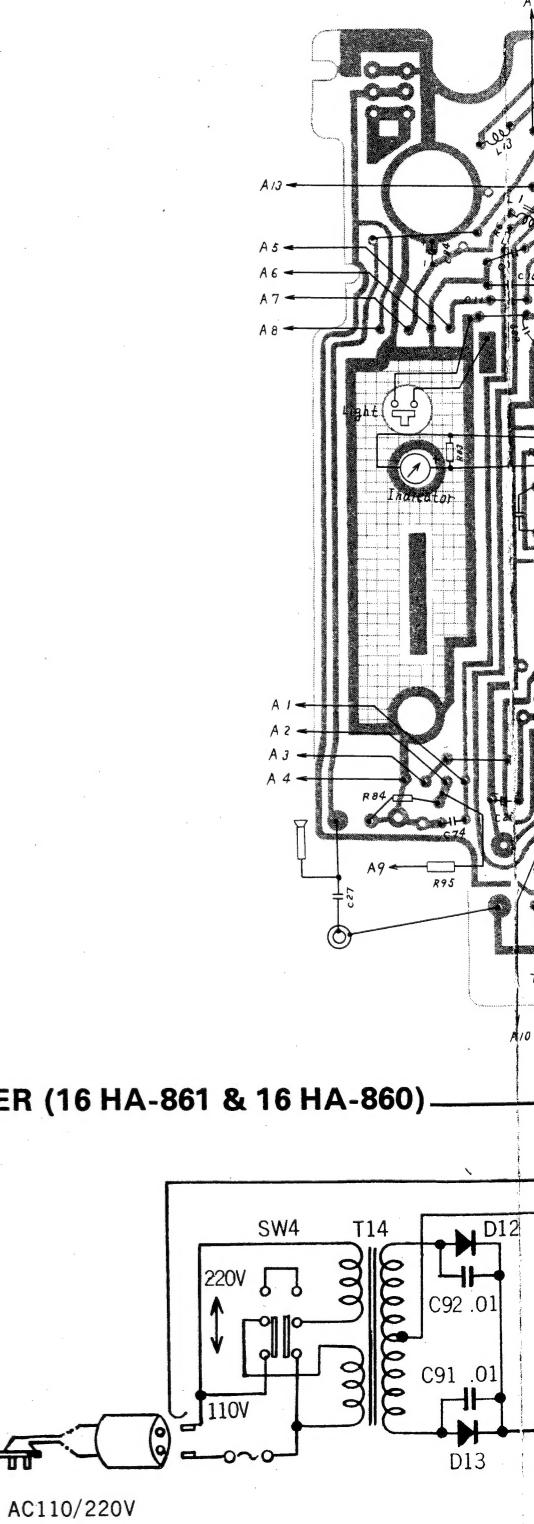


NOTE:

All resistance values in "ohms" K=1,000 ohms.

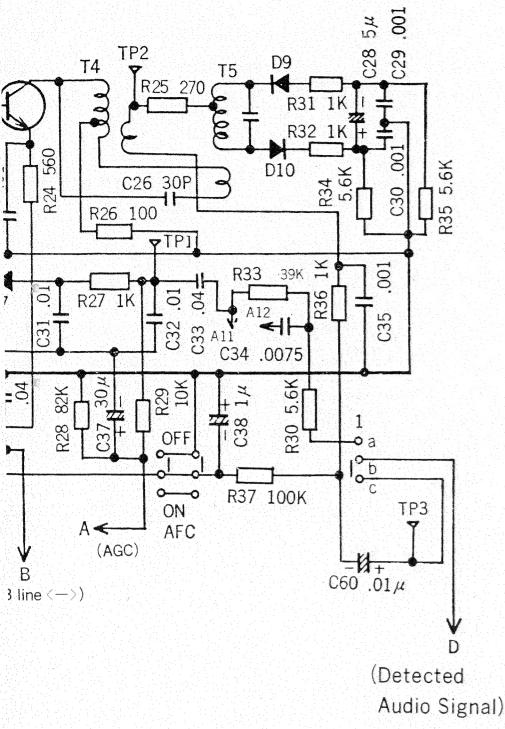
All capacitance values in " μ F" P=pF.

INTER-PARTS WIRING ILLUSTRATION
(RF and IF Stages)

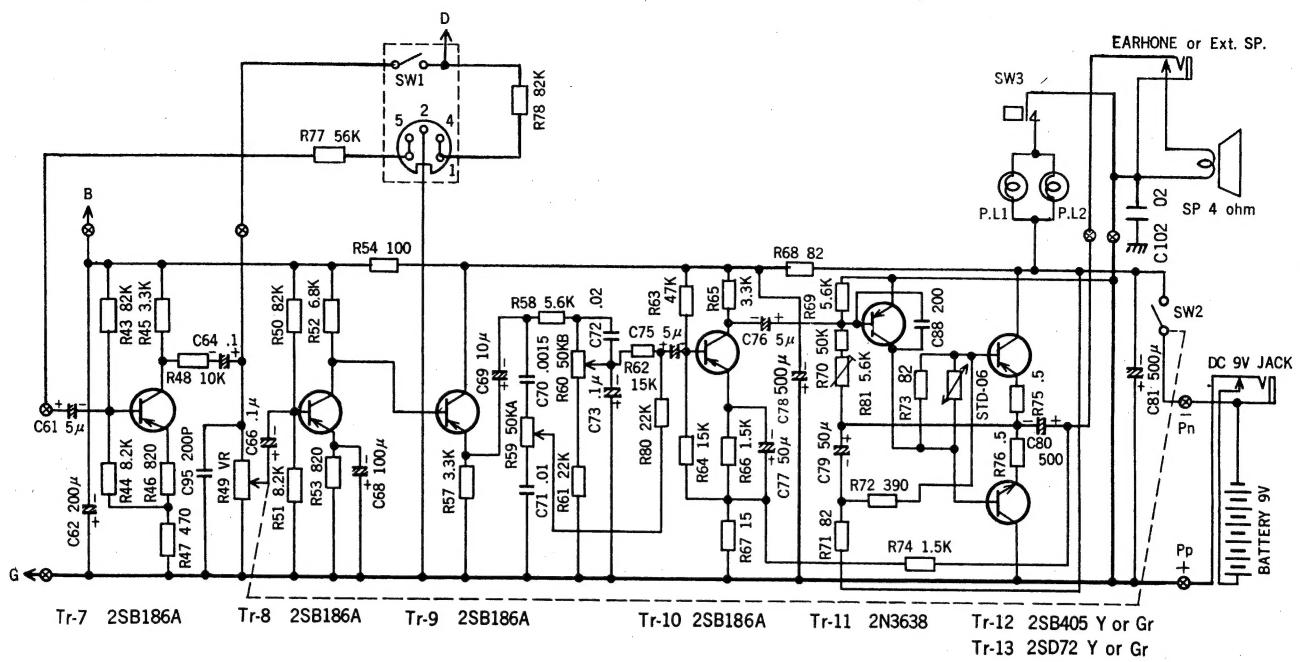


INTER-PARTS WIRING ILLUSTRATION
(RF and IF Stages)

2SC772C

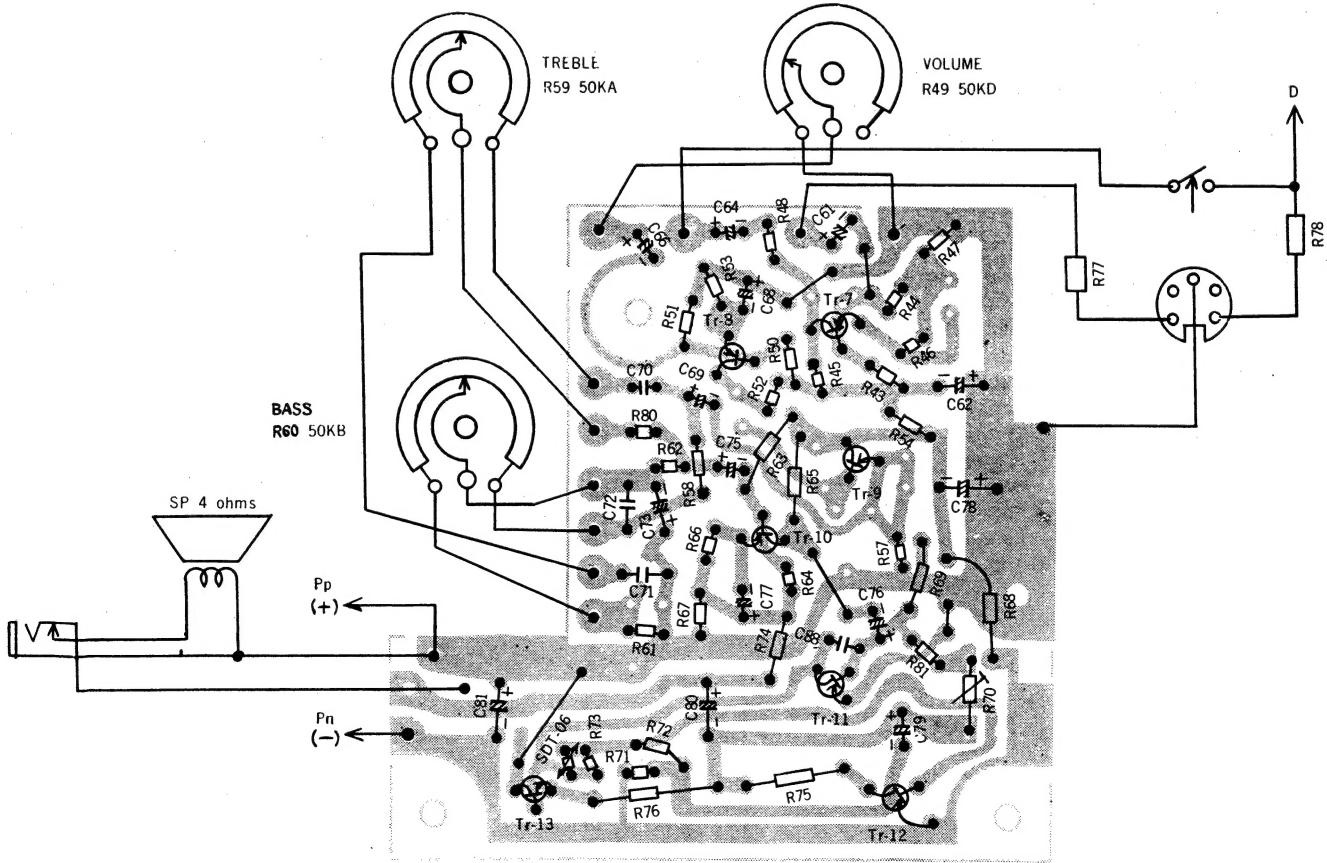


SCHEMATIC DIAGRAM (Audio Stages)



NOTE: Please be careful not to short-circuit the base of Tr11 (2N3638) to common line (negative line of battery supply) as it may lead to heavy damage on the transistor when careless shortcircuit made by a screw driver and other test equipments.

INTER-PARTS WIRING ILLUSTRATION (RF and IF Stages)



PARTS LIST

PARTS LIST

SCHEMATIC LOCATION	Part No.	Description	SCHEMATIC LOCATION	Part No.	Description			
CONTROLS								
R9 R70 R49	FM-100 R-C1152 R-C1146 R-C0058a R-R11010 R-R124187	FM Tuner Assembly Variable Capacitor, AM tuning capacitor Variable Capacitor, Fine tuning Trimmer Capacitor Semi-fixed Resistor, 50K Variable Resistor, 50K volume control Variable Resistor, 50KB treble control Variable Resistor, 50KA bass control Trimmer Capacitor Push Button Switch, band selector Push Switch, pilot switch Push Switch, AFC Slide Switch	L2 L3 L4 L5 L6 L7 L8 L9 L10 L11 L12 T1 T2 T3	R-W1059a R-W2353 R-W2352 R-W2351 R-W5T346	Choke Coil, 1.5mH Antenna Coil, SW4 Antenna Coil, SW1 SW2 SW3 Antenna Coil, LW MW IF Transformer, FM			
R59	R-R11692		T4	R-W5T292	IF Transformer, FM			
R60	R-R11693		T5	R-W5T237	IF Transformer, FM			
Ct1 Ct2	R-C0050a R-S4424 R-S4425b R-S4426 R-S4439		T6	R-W5T008-3	IF Transformer, AM			
			T7	R-W5T239	IF Transformer, AM			
			T8	R-W5T327-3	IF Transformer, AM			
			T9	R-W8264	Oscillator Coil, SW4			
			T10	R-W8263	Oscillator Coil, SW3			
			T11	R-W8262a-3	Oscillator Coil, SW1			
			T12	R-W8220a-3	Oscillator Coil, SW2			
			T13	R-W8219	Oscillator Coil, SW1			
			T14	R-W7128	Oscillator Coil, MW			
			L13	R-W9062	Step-down Transformer, AC power VHF Coil			
SEMICONDUCTORS								
Tr1	2SC645C or 2SC829C	Transistor, AM converter	CAPACITORS					
Tr2	2SC772E	Transistor	C1 C5 C14 C15 C25, C91 C92	R-CKS103Z	Ceramic	0.01 μ F	+80%	50V
Tr3 Tr4	2SC772D	Transistor	C2 C11 C12 C17 C19 C58 C102	R-CKD203Z	Ceramic	0.02 μ F	+80%	50V
Tr5 Tr6	2SC772C	Transistor	C3 C8 C28 C61 C75 C76 C84	R-C9882	Electrolytic	4.7 μ F	6.3V	
Tr7 Tr8 Tr9 Tr10	2SB186A	Transistor	C4 C6 C24 C59 C72 C85 C86	R-CQS203M	Mylar	0.02 μ F	\pm 20%	50V
Tr11	2N3638	Transistor	C7 C27 C44	R-CKD100K	Ceramic	10pF	\pm 10%	50V
Tr12	2SB405	Transistor, orange mark	C8 C10 C16 C21 C87 C89 C90	R-CKD403Z	Ceramic	0.04 μ F	+80%	50V
Tr13	2SD72	Transistor, orange mark	C9	R-CKS680J	Ceramic	68pF	\pm 5%	50V
Tr14	2SB492	Transistor,	C13	R-CQS302M	Mylar	0.003 μ F	\pm 20%	50V
D1 D5 D6 D7	1S188AM	Diode	C20 C29 C30 C35	R-CQS102M	Mylar	0.001 μ F	\pm 20%	50V
D3 D4	MA-26	Diode, silicon	C22 C88 C95	R-CKS201K	Ceramic	200pF	\pm 10%	50V
D9 D10	1S188D	Diode, FM discriminator	C23 C62 C90	R-C9877	Electrolytic	220 μ F	10V	
D11	1S334	Zener Diode, 8.9 \sim 9.6V	C26 C48	R-CKS300K	Ceramic	30pF	\pm 10%	50V
	R-S1347	Silicon Rectifier, 1S1849	C31 C32 C57 C71	R-CQS103M	Mylar	0.01 μ F	\pm 20%	50V
	SDT-06	Thermistor	C33	R-CQS403M	Mylar	0.04 μ F	\pm 20%	50V
RESISTORS								
R2 R30 R34 R35 R58 R69 R81	R-R562K	5.6K ohms \pm 10% 1/4W	C34	R-CQS752M	Mylar	0.0075 μ F	\pm 20%	50V
R3 R13 R45 R57 R65	R-R332K	3.3K ohms \pm 10% 1/4W	C37	R-C9881	Electrolytic	33 μ F	6.3V	
R4 R41 R77	R-R563K	56K ohms \pm 10% 1/4W	C38	R-C9203	Electrolytic	1 μ F	10V	
R5 R24	R-R561K	560 ohms \pm 10% 1/4W	C39 C46	R-CKD200K	Ceramic	20pF	\pm 10%	50V
R6	R-R222K	2.2K ohms \pm 10% 1/4W	C40 C42	R-CKS200K	Ceramic	20pF	\pm 10%	50V
R8 R17 R21 R22	R-R182K	1.8K ohms \pm 10% 1/4W	C45	R-CKD150K	Ceramic	15pF	\pm 10%	50V
R10 R14 R29 R48	R-R103K	10K ohms \pm 10% 1/4W	C47	R-CQT152K	Styrol	1500pF	\pm 10%	35V
R11 R16 R23 R38	R-R221K	220 ohms \pm 10% 1/4W	C49	R-CQT311K	Styrol	310pF	\pm 10%	35V
R20 R39 R86			C50	R-CQT162K	Styrol	165pF	\pm 10%	35V
R12 R18 R72 R85	R-R391K	390 ohms \pm 10% 1/4W	C51	R-CKD100K	Ceramic	10pF	\pm 10%	50V
R15 R26 R54 R92	R-R101K	100 ohms \pm 10% 1/4W	C52	R-CKS500J	Ceramic	50pF	\pm 5%	50V
R19	R-R272K	2.7K ohms \pm 10% 1/4W	C53 C54	R-CKS501M	Ceramic	500pF	\pm 20%	50V
R25 R83	R-R271K	270 ohms \pm 10% 1/4W	C55 C56	R-CQS502M	Mylar	0.005 μ F	\pm 20%	50V
R27 R31 R32 R36	R-R102K	1K ohms \pm 10% 1/4W	C60 C64 C66 C73 C74	R-C9126	Electrolytic	0.1 μ F	10V	
R84 R90			C68	R-C9134	Electrolytic	100 μ F	10V	
R28 R43 R50 R78	R-R823K	82K ohms \pm 10% 1/4W	C69	R-C9145	Electrolytic	10 μ F	10V	
R33	R-R393K	39K ohms \pm 10% 1/4W	C70	R-CQS152M	Mylar	0.0015 μ F	\pm 20%	50V
R37	R-R104K	100K ohms \pm 10% 1/4W	C78 C80 C81	R-C9905	Electrolytic	470 μ F	10V	
R40	R-R270K	27 ohms \pm 10% 1/4W	C77 C79	R-C9903	Electrolytic	47 μ F	10V	
R42 R46 R53	R-R821K	820 ohms \pm 10% 1/4W	C82	R-CKS800J	Ceramic	80pF	\pm 5%	50V
R44 R51	R-R822K	8.2K ohms \pm 10W 1/4W	C89	R-C9222	Electrolytic	220 μ F	25V	
R47	R-R471K	470 ohms \pm 10% 1/4W	C101	R-CKD050J	Ceramic	5pF	\pm 0.25pF	50V
R52	R-R682K	6.8K ohms \pm 10% 1/4W						
R61 R80	R-R223K	22K ohms \pm 10% 1/4W						
R62 R64	R-R153K	15K ohms \pm 10% 1/4W						
R63	R-R473K	47K ohms \pm 10% 1/4W						
R66 R74	R-R152K	1.5K ohms \pm 10% 1/4W						
R67	R-R150K	15 ohms \pm 10% 1/4W						
R68 R71 R73	R-R820K	82 ohms \pm 10% 1/4W						
R75 R76	R-RON5K	0.5 ohm \pm 10% -W						
R82	R-R333K	33K ohms \pm 10% 1/4W						
R88	R-R220K	22 ohms \pm 10% 1/4W						
R89	R-R180K	18 ohms \pm 10% 1/4W						
R91	R-R334K	330K ohms \pm 10% 1/4W						
R93	R-R124K	120K ohms \pm 10% 1/4W						
R94	R-R392K	3.9K ohms \pm 10% 1/4W						
R95	R-R330K	33 ohms \pm 10% 1/4W						

HOW TO ORDER REPLACEMENT PARTS

All parts listed herein may be ordered through our SERVICE DEPARTMENT of SANYO ELECTRIC TRADING CO., LTD. or Sanyo authorized service stations or agents. When ordering parts by mail parts will be shipped at prevailing prices and you will be billed accordingly.

WHEN ORDERING REPLACEMENT PARTS, ALWAYS GIVE THE FOLLOWING INFORMATION AS SHOWN IN THIS LIST:

1. The PART NUMBER.
2. The PART NAME or DESCRIPTION.
3. The MODEL NUMBER 16HA-861

SANYO AUTHORIZED AGENTS AND SERVICE STATIONS

JAPAN	SERVICE DEPARTMENT, SANYO ELECTRIC TRADING CO., LTD. 18-2, Keihan-hondori, Moriguchi, Osaka, Japan	THAILAND	SANYO (THAILAND) LTD. No. 175-7, Suriwong St., Bangkok, Thailand.	ENGLAND	SANYO MARUBENI (U.K.) LTD. Bushey Mill Lane, Wat- ford, Hertfordshire, U.K.	KUWAIT	SUPPLYING STORE. P.O. Box 1154, Kuwait.
	OKINAWA SANYO CO., LTD. No. 10-2 Chome, Higa shi-machi, Naha, Okinawa	SINGAPORE	SANYO MALAYSIA LTD. 50, South Bridge Road, Singapore-1.	SWITZERLAND	M. SPITZER-MILEGER Steinengraben 21, P.O. Box 4001 Basel, Switzerland.	USA	SANYO ELECTRIC INC. 50-52 Joseph Street Moonachie, New Jersey 07074
HONGKONG	HONGKONG TATT SHING SANYO ELECTRIC CO., LTD. 4th Floor, Wang Kee Building, 34-37, Con- naught Road, Central Hong Kong.	MALAYSIA	THE BORNEO CO., (MALAYSIA) SDN. BHD. 80, Jalan Ampang, Kua- la Lumpur, Malaysia.	ITALY	SELFIX ITALIANA s.r.l. Via Omboni 5, Milano, Italy	HAWAII	SERVCO PACIFIC INC. P.O. Box 2788 556, Pohukaina St., Honolulu, Hawaii
	AUSTRALIA	SANYO SALES & SERVICE CO., LTD. 327, Spencer Street, Melbourne, Australia.	SOUTH AFRICA	TELTRON (PTY.) LTD. 146, Market Street, Johannesburg, South Africa	LEBANON	CANADA	M/S MAGNASONIC CANADA LTD. Perma Building 4980 Buchan St., Montreal 9, P.Q., Canada.
					HIBA TRADING CO. Salem Building, Hoyek Street, Beyrouth, Lebanon.		